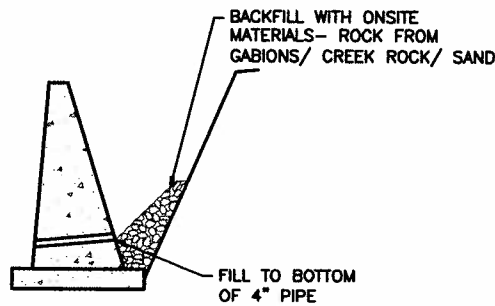


**RETAINING**

**WALLS**

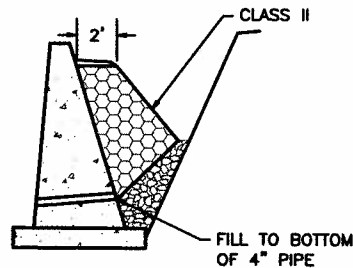
# BACKFILL PROCEDURE

## STEP 1



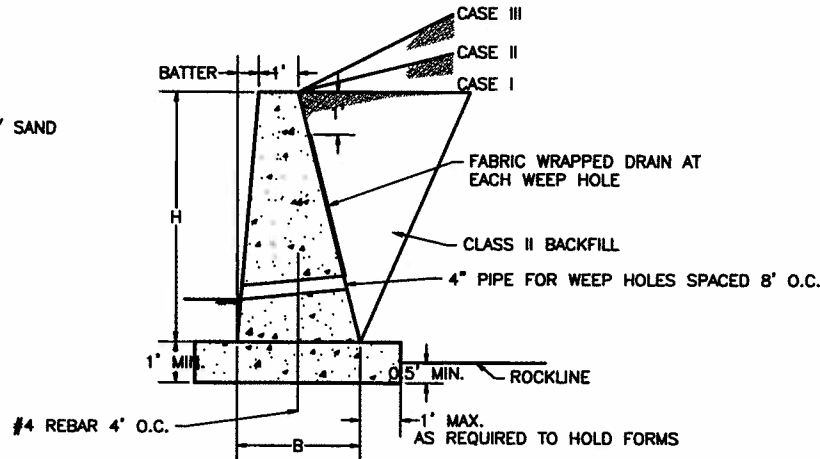
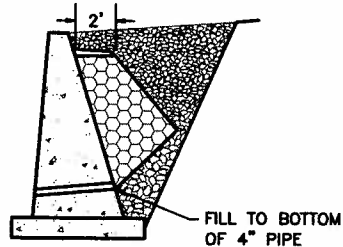
## STEP 2

PLACE FILTER FABRIC AND CLASS II SUBDRAIN ROCK AS SHOWN



## STEP 3

FILL REMAINING AREA WITH ONSITE MATERIALS AS DIRECTED BY THE ENGINEER



CONCRETE GRAVITY WALL FOR STREAM WORK & ROCK BASE

NTS

THE RETAINING WALL DEPICTED ON THIS DRAWING SHALL BE USED WHEN THE HEIGHT (H DIMENSION) OF THE WALL IS 12'-0" OR LESS PROVIDED THE FILL COMPLIES WITH THE FOLLOWING CONDITIONS:

CASE I: WALL BACKFILL SLOPES DOWN, IS LEVEL, OR SLOPES UP FROM WALL AT 20:1 OR FLATTER SLOPE ALLOWS FOR BACKFILL WHICH WOULD BE LEVEL EXCEPT FOR THE SLOPE REQUIRED TO FACILITATE PROPER DRAINAGE.

CASE II: BACKFILL SLOPES UP STEEPER THAN 20:1, BUT NOT STEEPER THAN 4:1.

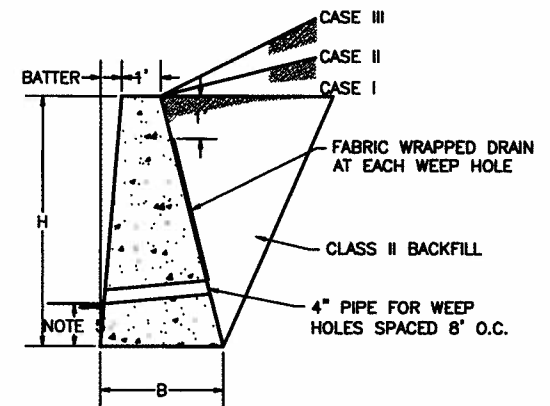
CASE III: BACKFILL SLOPES UP STEEPER THAN 4:1, BUT NOT STEEPER THAN 2:1. WHEN 'H' IS GREATER THAN 8' (6' FRONT FACE) INCREASE THE EMBEDMENT DEPTH TO 1/4 'H.'

SPECIAL DESIGNS SHALL BE REQUIRED WHEN THE FOLLOWING CONDITIONS EXIST:

- WALL HEIGHT IS GREATER THAN 12'-0"
- WALL IS SURCHARGED WITH DEAD LOAD FILL SLOPES STEEPER THAN 2:1
- WALL IS SURCHARGED WITH A LIVE LOAD, WITHOUT THE LIMITS OF A 1:1 SLOPE EXTENDING FROM THE BASE OF THE WALL.

AREAS AND VOLUMES HAVE BEEN COMPUTED WITHOUT REDUCTION FOR BEVELED EDGES OR PIPE DRAINS. WHEN A RETAINING WALL VARIES IN HEIGHT, THE PRISMOIDAL FORMULA SHALL BE USED IN COMPUTING VOLUMES. THE FOOTER IS NOT INCLUDED IN THE TABULATED VOLUMES.

- BATTER:
  - CASE I AND CASE II
    - H = 3'-0" TO LESS THAN 5'-0" (VERTICAL)
    - H = 5'-0" TO LESS THAN 10'-0" (12:1)
    - H = 10'-0" TO LESS THAN 12'-0" (6:1)
  - CASE III
    - H = 3'-0" TO LESS THAN 5'-0" (12:1)
    - H = 5'-0" TO LESS THAN 12'-0" (6:1)
- FABRIC WRAPPED DRAINS AND 4" PIPE SOIL WEEP HOLES SHALL BE INCLUDED IN THE UNIT PRICE FOR GRAVITY TYPE RETAINING WALLS.
- PLACE GEOGRID UNDER THE BASE OF THE WALL AS DIRECTED BY THE ENGINEER.
- CONCRETE SHALL BE CLASS A CONCRETE WITH FIBER REINFORCEMENT.
- MINIMUM EMBEDMENT VALUE FOR FIRM EARTH IS 2'-0".



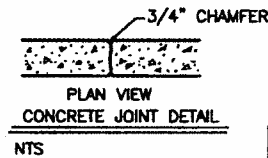
CONCRETE GRAVITY WALL FOR SOIL

NTS

HEIGHT	BASE	SQ FT	CY/LF
CASE I OR II OR III			
3'-0"	1'-6"	3.7500	0.1389
3'-6"	1'-9"	4.8125	0.1782
4'-0"	2'-0"	6.0000	0.2222
4'-6"	2'-3"	7.3125	0.2708
5'-0"	2'-6"	8.7500	0.3241
5'-6"	2'-9"	10.3125	0.3819
6'-0"	3'-0"	12.0000	0.4444
6'-6"	3'-3"	13.8125	0.5116
7'-0"	3'-6"	15.7500	0.5833
7'-6"	3'-9"	17.8125	0.6597
8'-0"	4'-0"	20.0000	0.7407
8'-6"	4'-3"	22.3125	0.8264
9'-0"	4'-6"	24.7500	0.9167
9'-6"	4'-9"	27.3125	1.0116
CASE I			
10'-0"	5'-0"	30.0000	1.1111
10'-6"	5'-3"	32.8125	1.2153
11'-0"	5'-6"	35.7500	1.3241
11'-6"	5'-9"	38.8125	1.4375
12'-0"	6'-0"	42.0000	1.5556
CASE II OR III			
10'-0"	6'-0"	35.0000	1.2963
10'-6"	6'-3"	38.0625	1.4097
11'-0"	6'-6"	41.2500	1.5278
11'-6"	6'-9"	44.5625	1.6505
12'-0"	7'-0"	48.0000	1.7778

# CONSTRUCTION NOTES:

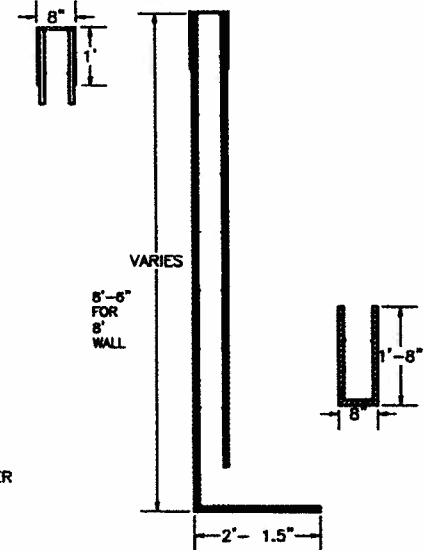
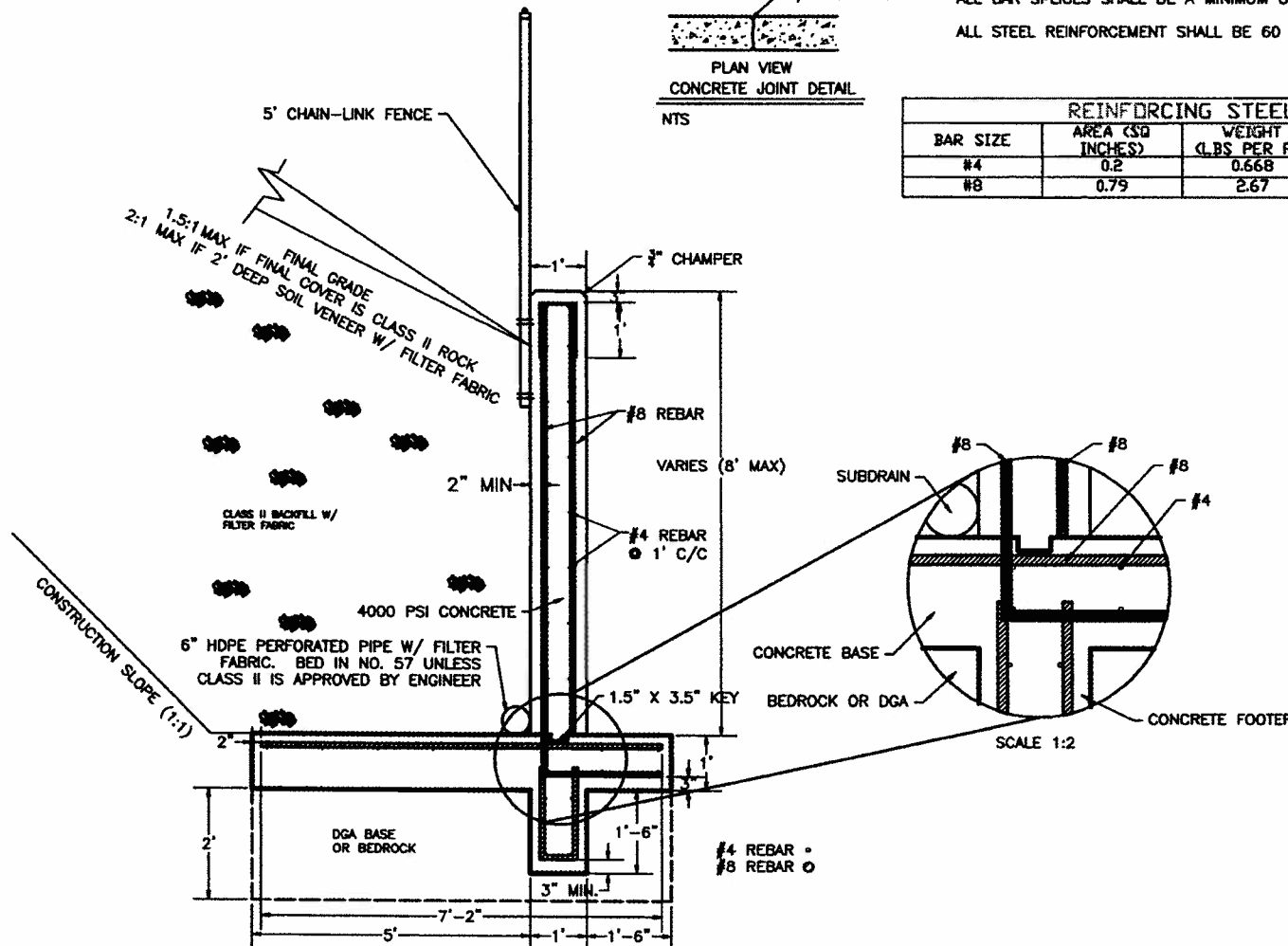
1. ALL FOUNDATION EXCAVATION AREA SHALL BE APPROVED BY THE ENGINEER, PRIOR TO THE PLACEMENT OF FORMWORK AND REBAR PLACEMENT. IN THE OPINION OF THE ENGINEER, ANY AREA NOT SUITABLE FOR FOOTING PLACEMENT (I.E. SOFT, SATURATED, ETC.) SHALL BE OVER EXCAVATED AND BACKFILLED WITH MECHANICALLY COMPACTED DENSE GRADE AGGREGATE AS DESCRIBED IN THE TECHNICAL SPECIFICATIONS AND DIRECTED BY THE ENGINEER.
2. ALL REINFORCING BARS ARE 2" FROM EDGE UNLESS OTHERWISE NOTED.
3. SAFETY FENCE MAY BE BOLTED TO THE WALL OR SET INPLACE WITH CONCRETE BEHIND THE WALL. DO NOT PLACE FENCE IN THE WALL.



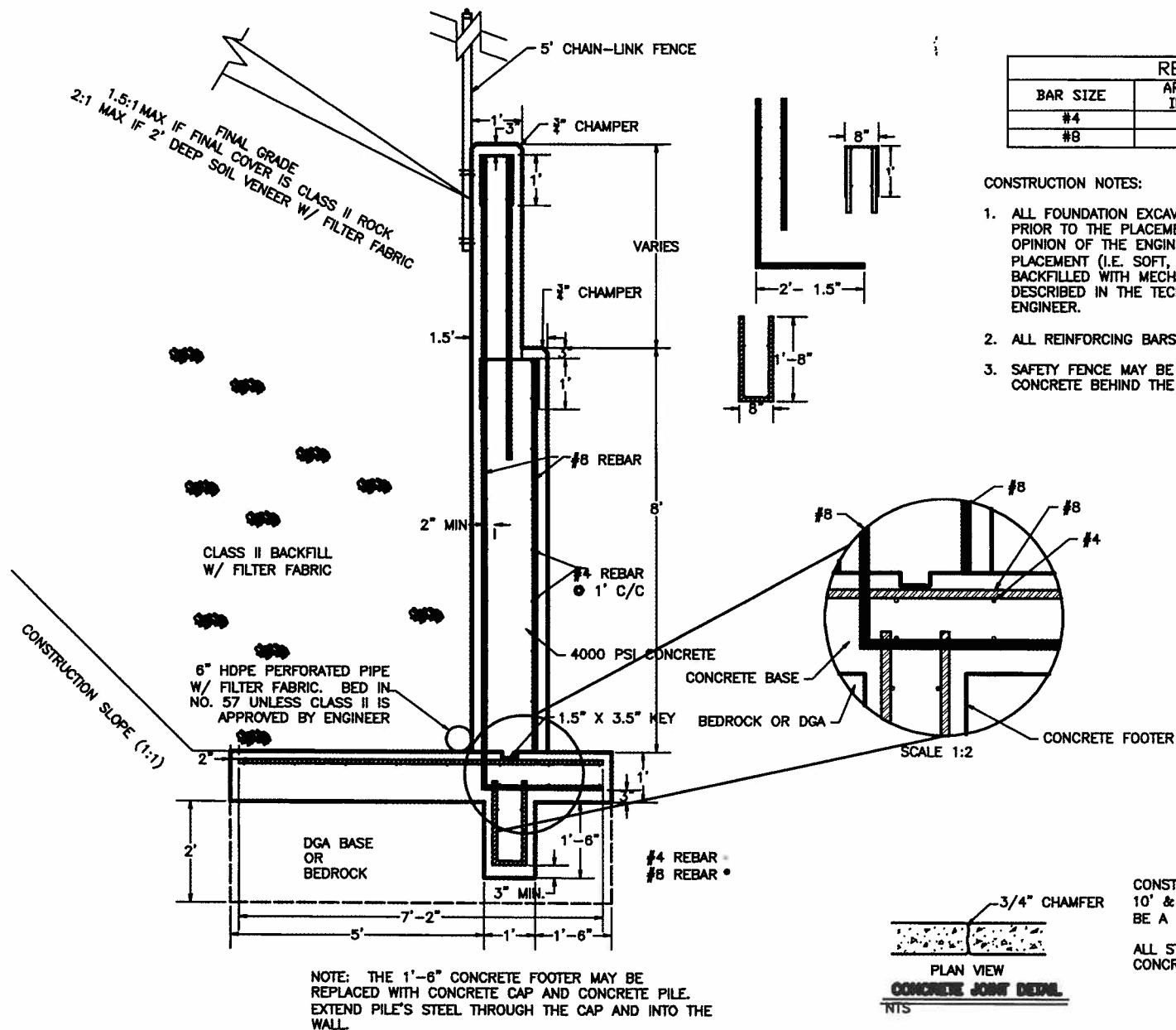
CONSTRUCTION JOINTS SHALL BE PLACED A MINIMUM OF 10' & A MAXIMUM OF 20'.  
ALL BAR SPLICES SHALL BE A MINIMUM OF 18" AND A MAXIMUM OF 24".

ALL STEEL REINFORCEMENT SHALL BE 60 KIP. ALL CONCRETE SHALL BE 4000 PSI.

REINFORCING STEEL			
BAR SIZE	AREA (SQ INCHES)	WEIGHT (LBS PER FT)	DIAMETER (INCHES)
#4	0.2	0.668	0.500
#8	0.79	2.67	1.000



REINFORCED CONCRETE RETAINING WALL  
AMLRW 2



REINFORCING STEEL			
BAR SIZE	AREA (SQ INCHES)	WEIGHT (LBS PER FT)	DIAMETER (INCHES)
#4	0.2	0.668	0.500
#8	0.79	2.67	1.000

#### CONSTRUCTION NOTES:

1. ALL FOUNDATION EXCAVATION AREA SHALL BE APPROVED BY THE ENGINEER, PRIOR TO THE PLACEMENT OF FORMWORK AND REBAR PLACEMENT. IN THE OPINION OF THE ENGINEER, ANY AREA NOT SUITABLE FOR FOOTING PLACEMENT (I.E. SOFT, SATURATED, ETC.) SHALL BE OVER EXCAVATED AND BACKFILLED WITH MECHANICALLY COMPACTED DENSE GRADE AGGREGATE AS DESCRIBED IN THE TECHNICAL SPECIFICATIONS AND DIRECTED BY THE ENGINEER.
2. ALL REINFORCING BARS ARE 2" FROM EDGE UNLESS OTHERWISE NOTED.
3. SAFETY FENCE MAY BE BOLTED TO THE WALL OR SET INPLACE WITH CONCRETE BEHIND THE WALL. DO NOT PLACE FENCE IN THE WALL.

CONSTRUCTION JOINTS SHALL BE PLACED A MINIMUM OF 10' & A MAXIMUM OF 20'. ALL BAR SPLICES SHALL BE A MINIMUM OF 18" AND A MAXIMUM OF 24".

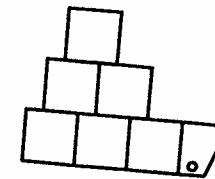
ALL STEEL REINFORCEMENT SHALL BE 60 KIP. ALL CONCRETE SHALL BE 4000 PSI.

SLOPE 2:1 MAX FOR 2' SOIL VENEER  
SLOPE 1.5:1 FOR ROCK

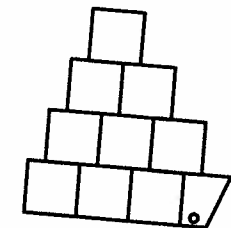
CHAIN-LINK FENCE  
WHERE REQUIRED

GABION BASKETS

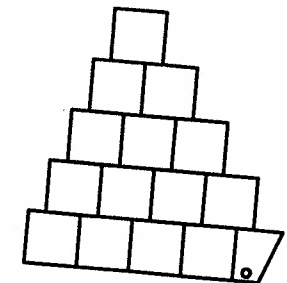
1. RAILROAD STEEL 10 INCH DRILLED HOLES, MINIMUM 10' INTO ROCK, GROUTED THROUGH SOIL AND ROCK.
2. ENGINEER MAY SUBSTITUTE CLASS II BACKFILL BEDDING IF DEPTH TO ROCK IS SHALLOW.
3. ONLY BURY 1/2 BASKET FOR WALLS SHORTER THAN 9 FT.



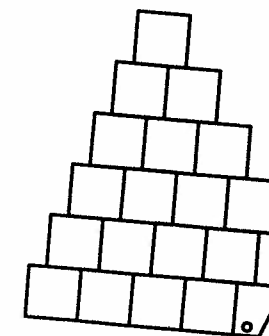
9' WALL



12' GABION



15' WALL



18' WALL

CONSTRUCTION SLOPE

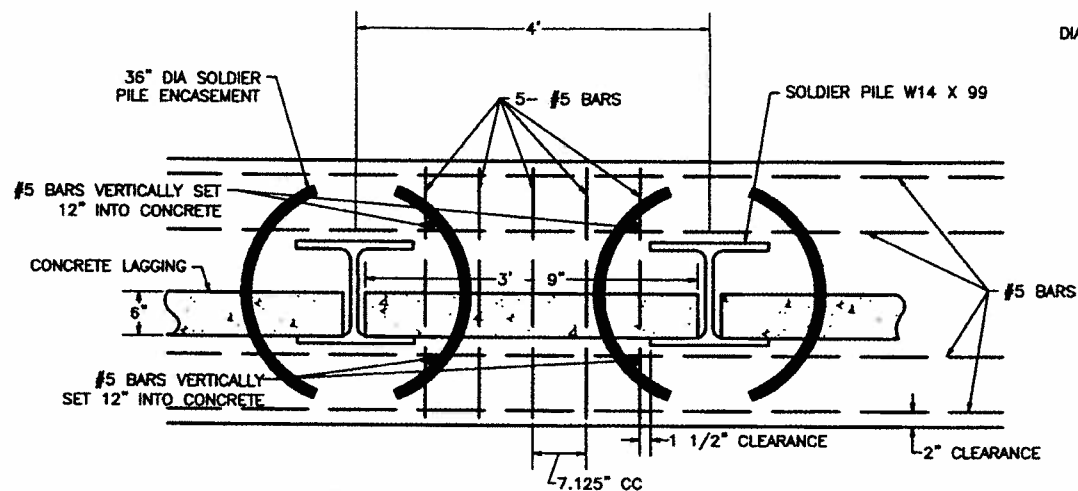
DEPENDING ON ROCK LINES ENCOUNTERED, THE  
SHADED BASKETS MAY BE OMITTED BY ENGINEER

NO. 2 STONE SURROUNDED BY  
FILTER FABRIC (1' OVERLAP)

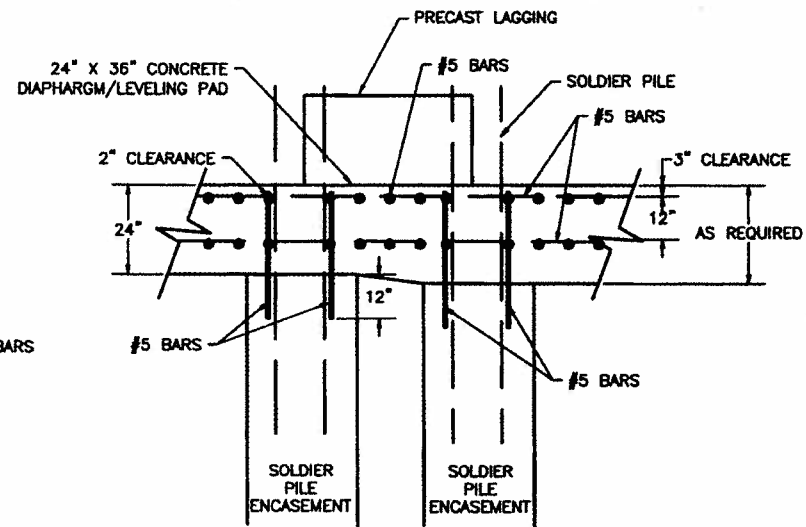
6" HDPE PERFORATED PIPE

CLASS II LEVELING PAD AS NEEDED

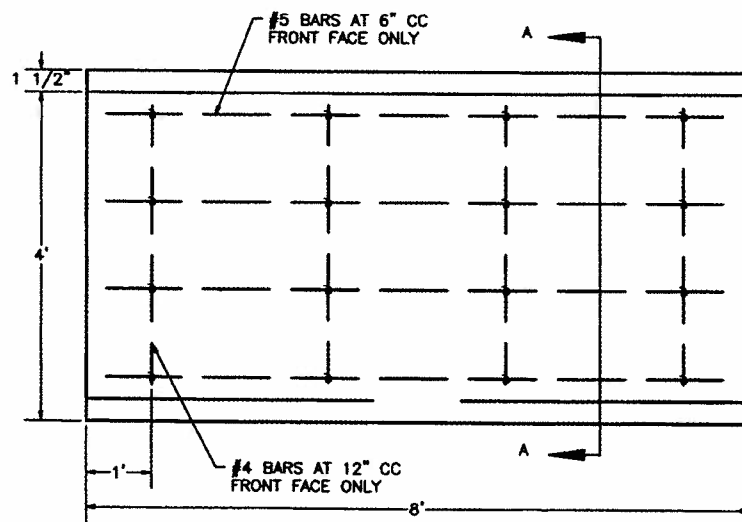
RAIL STEEL FOUNDATION  
(IF REQUIRED)



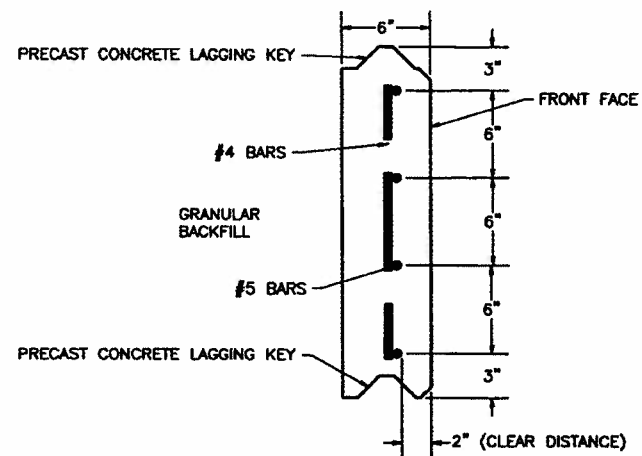
PLAN VIEW  
NTS



ELEVATION  
NTS



PRECAST CONCRETE LAGGING  
1:6



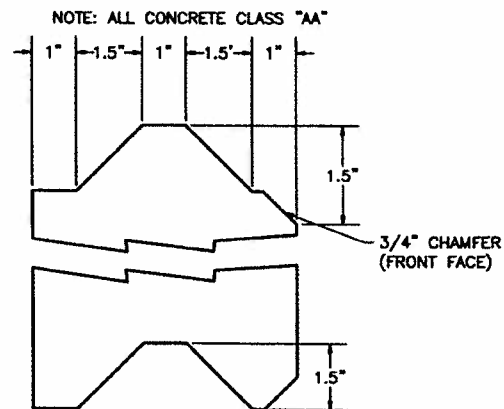
SECTION A-A  
1:6

PILE AND LAGGING WALL  
AMLRW 5-1

NOTE:

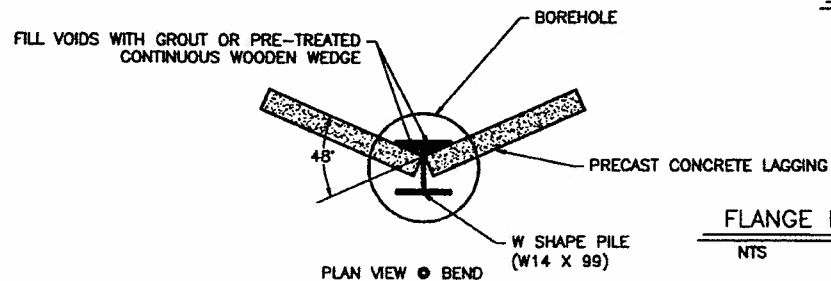
THE CONTRACTOR SHALL NOTIFY THE ENGINEER PRIOR TO FORMING AND/OR POURING ANY PANELS SUCH THAT THE ENGINEER MAY HAVE A REPRESENTATIVE ON SITE PRIOR TO AND DURING THE POURING PROCESS.

ALL STEEL REINFORCEMENT SHALL BE ACCURATELY PLACED IN THE FORMS VERTICALLY AND HORIZONTALLY OF THE THE POSITIONS SHOWN. THE REINFORCEMENT CAGE (REBARS) SHALL BE HELD FIRMLY IN PLACE BY THE USE OF CHAIRS AND WIRE TIES DURING THE VIBRATION, AGITATION, AND CURING CYCLES OF THE CONCRETE TO PREVENT MOVEMENT. WIRE TIES SHALL BE USED IN THE FABRICATION OF THE REINFORCEMENT CAGE (REBARS). ALL STEEL REINFORCEMENT SHALL BE 60 KIP AND SHALL CONFORM TO ASTM A-615. WELDING SHALL NOT BE PERMITTED.

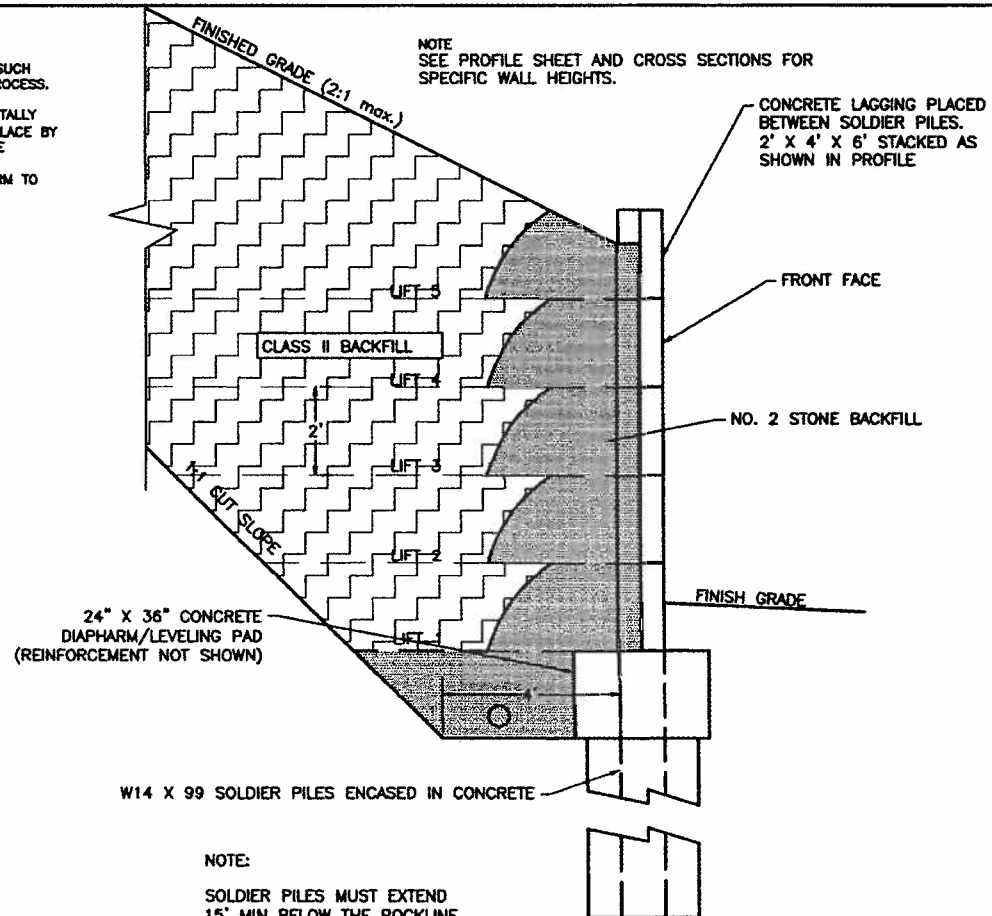


PRECAST CONCRETE LAGGING KEY

2:1



NOTE  
SEE PROFILE SHEET AND CROSS SECTIONS FOR  
SPECIFIC WALL HEIGHTS.

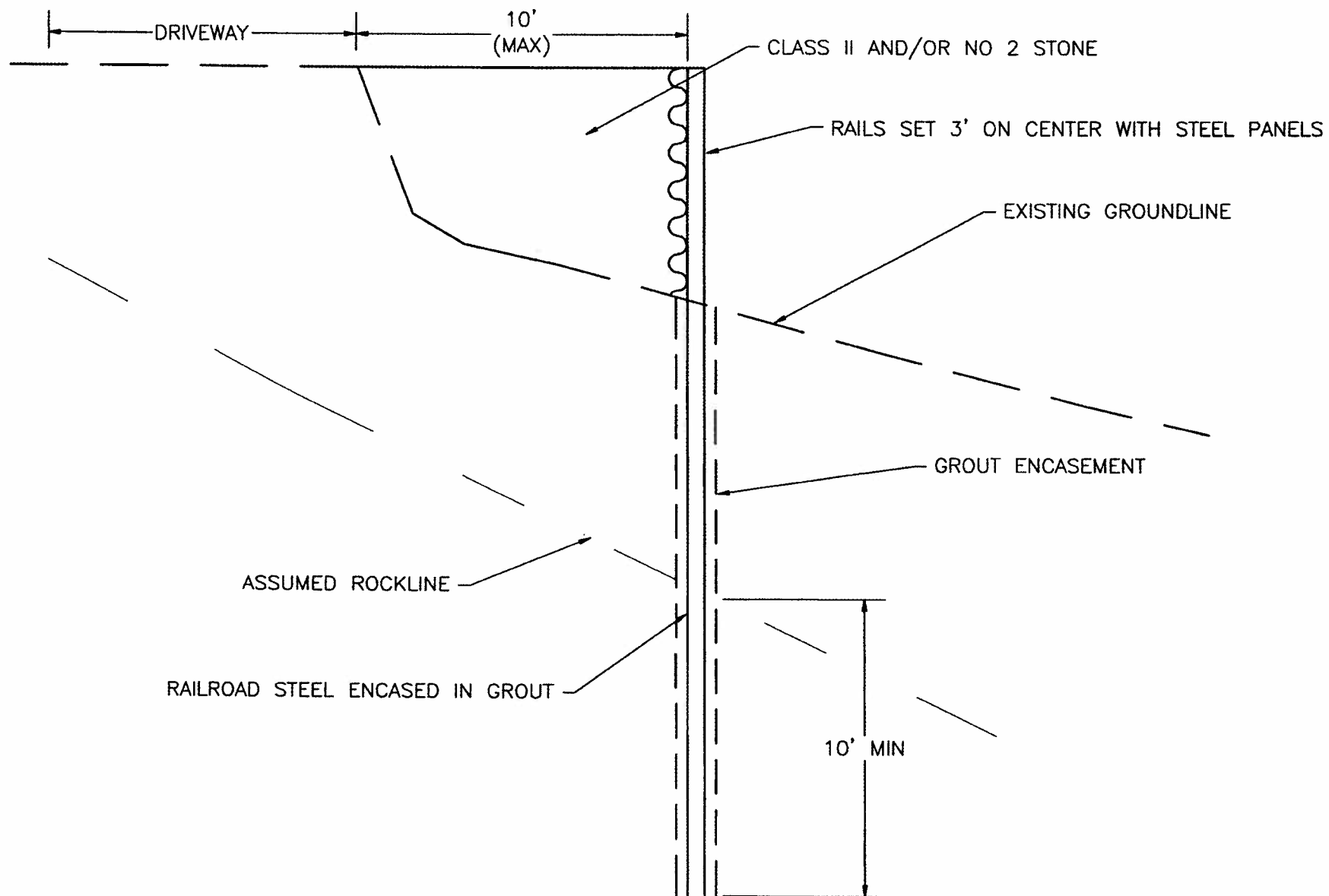


SECTION -- PILE AND LAGGING WALL

NTS

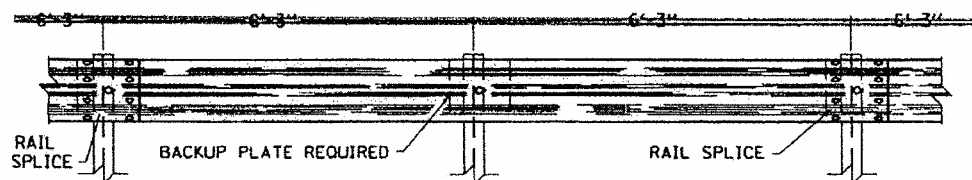
FLANGE PRESSURE DISTRIBUTION DETAIL

NTS

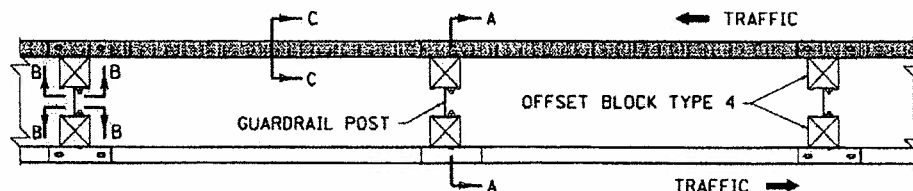


RAIL STEEL GUARDRAIL PANEL WALL  
AMLRW 6-1

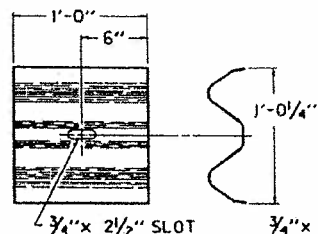




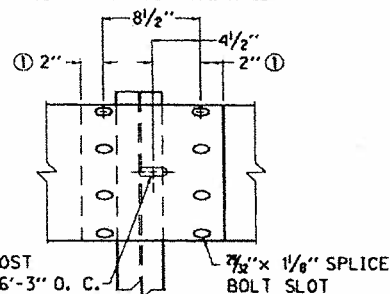
ELEVATION VIEW



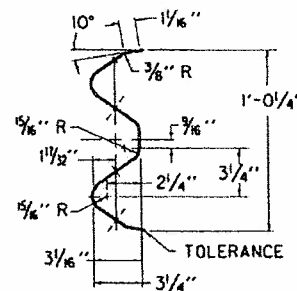
PLAN VIEW  
(DOUBLE FACE RAIL OR SINGLE FACE RAIL)



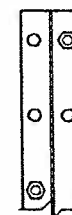
BACK-UP PLATE



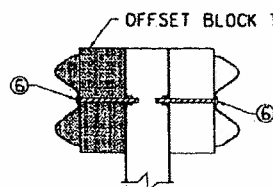
RAIL SPLICE ②



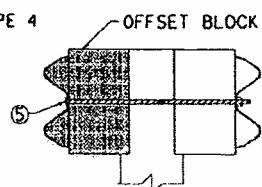
SECTION C-C  
(RAIL CORRUGATED SHEET STEEL BEAM)



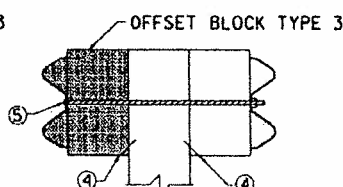
SECTION B-B



SECTION A-A  
DOUBLE FACE RAIL WITH  
STEEL POST (W6x9)  
(TIMBER OFFSET BLOCK)



SECTION A-A  
DOUBLE FACE RAIL WITH  
ROUND TIMBER POST



SECTION A-A  
DOUBLE FACE RAIL WITH  
TIMBER POST

# NOTES

THE CONTRACT UNIT PRICE BID SHALL BE:  
GUARDRAIL-STEEL W BEAM-SINGLE FACE - LIN. FT.  
OR

GUARDRAIL-STEEL W BEAM-DOUBLE FACE - LIN. FT.  
DIMENSIONAL TOLERANCES NOT SHOWN OR IMPLIED ARE  
INTENDED TO BE THOSE CONSISTENT WITH THE PROPER  
FUNCTIONING OF THE PART, INCLUDING ITS APPEARANCE  
AND ACCEPTED MANUFACTURING PRACTICES.

THE RAIL ELEMENT SHALL COMPLY WITH AASHTO M-180  
-CLASS A, TYPE II.

ALL LAPS SHALL BE PLACED IN THE DIRECTION OF TRAFFIC  
FLOW.

① TOLERANCE + 1/4", -1/4"

② 8 - 5/8" x 1 1/4" LONG BUTTON HEAD BOLTS AND HEX HEAD  
RECESS NUTS REQUIRED FOR EACH RAIL SPLICE.

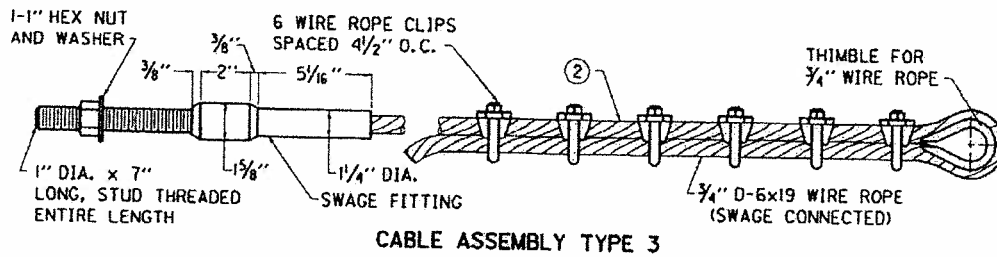
③ LENGTH EQUALS POST AND BLOCK WIDTH PLUS: 2"  
FOR BOLT OR 2 1/4" FOR THREADED ROD.

④ GALVANIZED STEEL 10d COMMON COATED NAIL (DRIVE  
NAIL AT THE TOP OR BOTTOM CENTER OF BLOCK AND  
POST AFTER BOLT IS INSTALLED).

⑤ 5/8" x ① STEEL THREADED ROD AND TWO (2) HEX  
HEAD NUTS OR 5/8" x ③ BUTTON OR HEX HEAD BOLT  
AND HEX HEAD NUT.

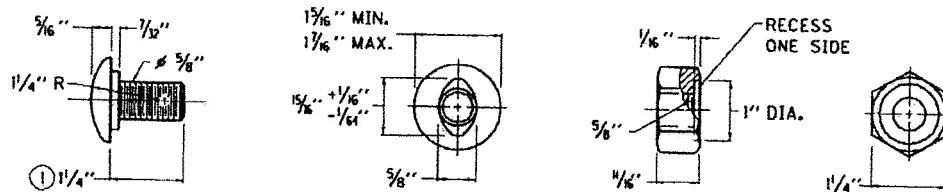
⑥ 5/8" x 8" BUTTON HEAD BOLT, HEX HEAD RECESS NUT  
AND ONE 3/8" ROUND WASHER (TYP.). BOLT SHALL HAVE  
A MINIMUM THREAD LENGTH OF 2".

⑥⑥ REQUIRED FOR DOUBLE RAIL

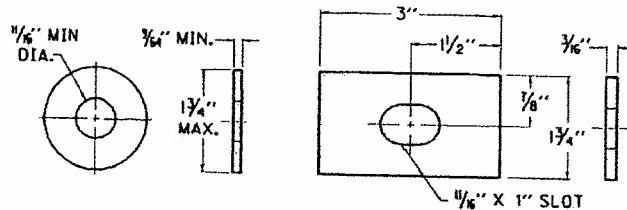


#### NOTES

- ① RAIL BOLT SIMILAR EXCEPT LENGTH.
- ② CABLE ASSEMBLY TYPE 3 - GUARDRAIL END TREATMENT TYPE 2A
- ③ THE THRIE BEAM TO "W" BEAM CONNECTOR SHALL COMPLY WITH AASHTO M-180 CLASS A, TYPE 2 EXCEPT WHERE IN CONFLICT WITH THIS DETAIL.

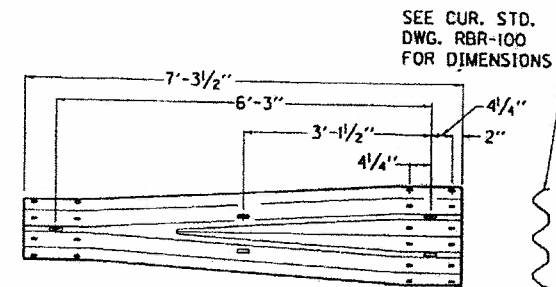


**$\frac{5}{8}$ " BUTTON HEAD BOLT AND RECESSED NUT**

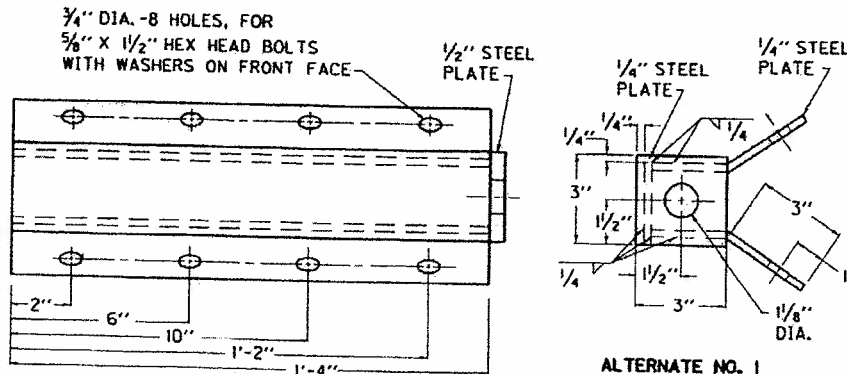


**ROUND WASHER AND RECTANGULAR PLATE WASHER**

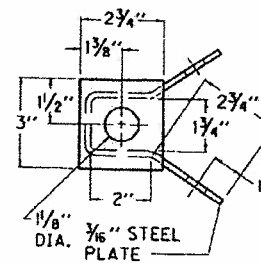
SEE CUR. STD.  
 DWG. RBR-001  
 FOR DIMENSIONS



**THRIE BEAM TO "W" BEAM CONNECTOR ③**

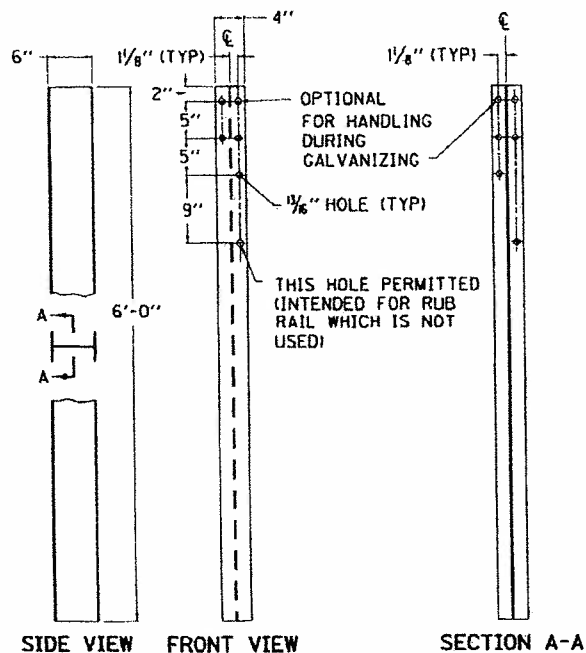


**ALTERNATE NO. 1**

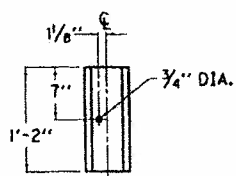


**ALTERNATE NO. 2**

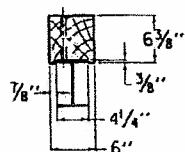
**RAIL ANCHOR ASSEMBLY**



~ W6 X 9.0 STEEL POST ① ~



REAR ELEVATION



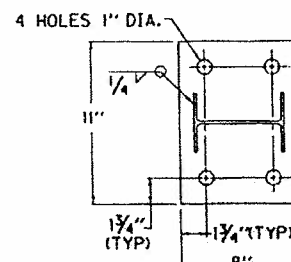
PLAN VIEW

OFFSET BLOCK TYPE 4  
(TIMBER)

(FOR USE WITH STEEL POST ONLY)

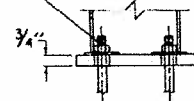
~ NOTES ~

① W6 X 8.5 IS AN ACCEPTABLE ALTERNATE.

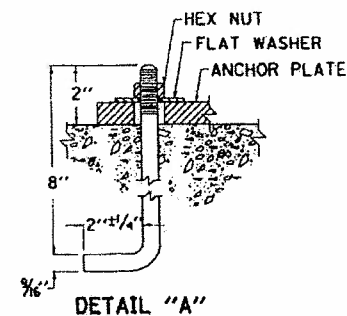


PLAN VIEW

SEE DETAIL "A"

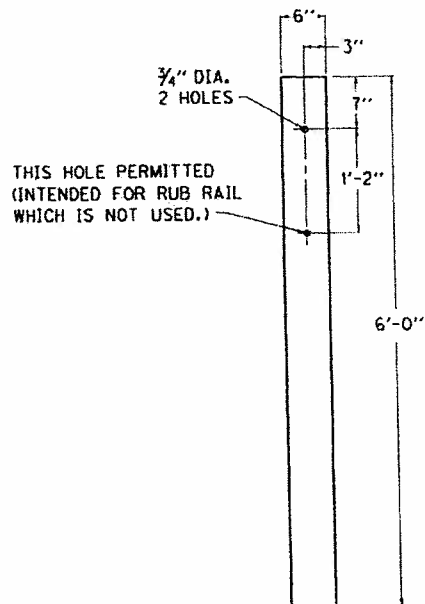


SIDE VIEW  
ANCHOR PLATE

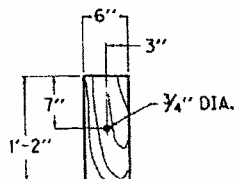




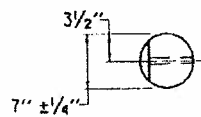
PLAN VIEW



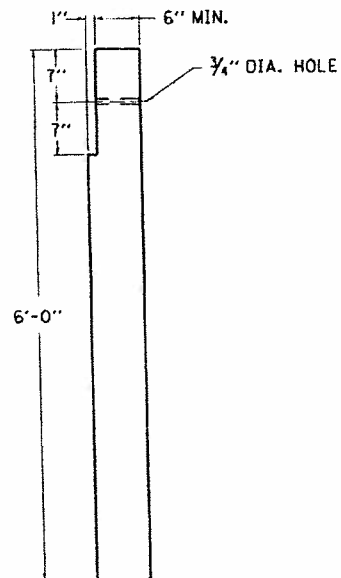
FRONT ELEVATION  
6"x8" TIMBER POST



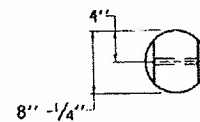
FRONT ELEVATION  
OFFSET BLOCK TYPE 3  
(6" X 8" TIMBER)  
(FOR USE WITH RECTANGULAR  
AND ROUND POSTS)



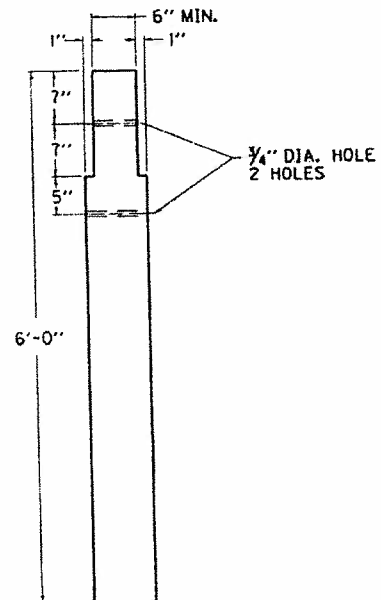
PLAN VIEW



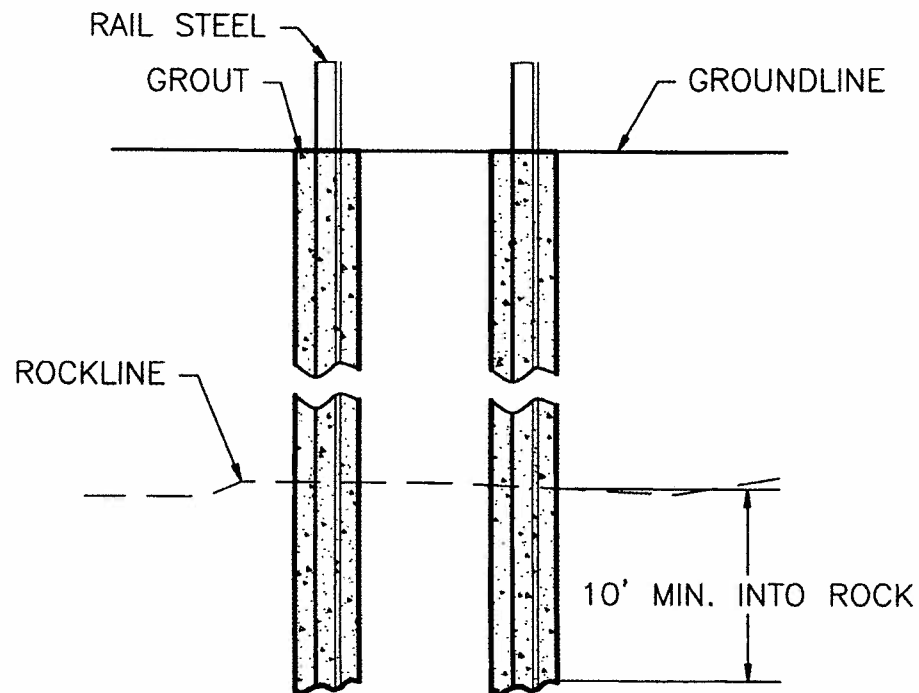
7" ROUND TIMBER POST  
(SINGLE FACE RAIL)



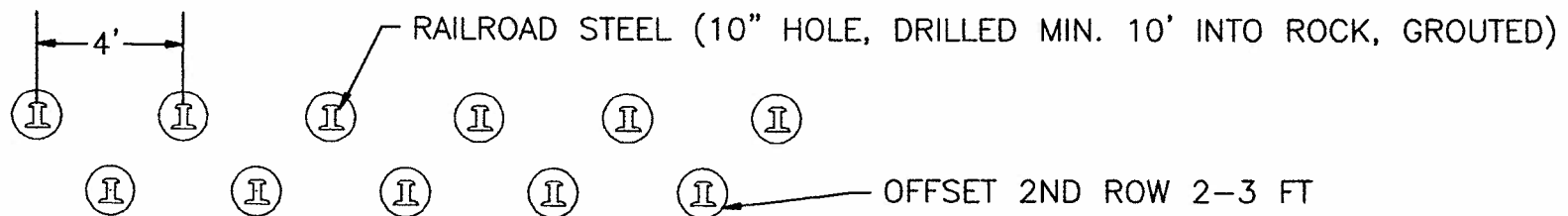
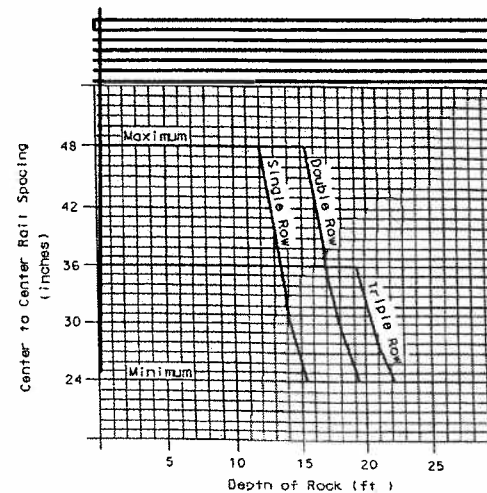
PLAN VIEW



8" ROUND TIMBER POST  
(DOUBLE FACE RAIL)



Design Chart for  
130 to 133 lb./yd. Rails



#### NOTES:

1. IF DEPTHS TO ROCK EXCEED 20' THE ENGINEER MAY REQUIRE ADDITIONAL EXCAVATION.
2. RAILS SHALL BE ORIENTED WITH FLANGES PERPENDICULAR TO POSSIBLE SLIDE MOVEMENT.
3. RAILS SHALL BE ENCASED WITH GROUT FOR THE ENTIRE DEPTH OF THE HOLE.
4. RAILS SHALL BE USED RAILROAD RAILS WITH A MINIMUM WEIGHT OF 130 LBS/YD
5. RAILS SHALL BE STRAIGHT AND STRUCTURALLY SOUND. NO SPLICING SHALL BE ALLOWED.

QUANTITY (36" PILING REBAR)  
4' X 2' CONCRETE CAP

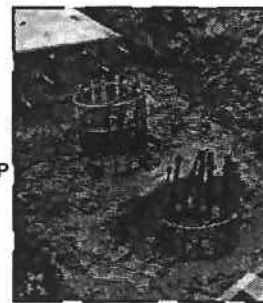
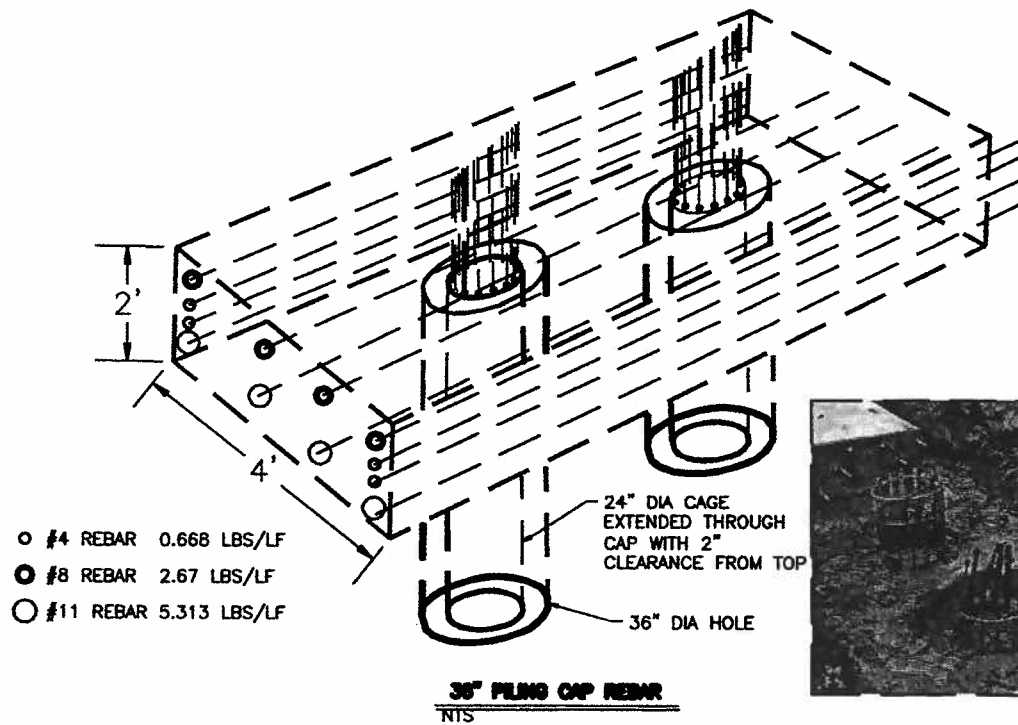
STEEL = 34.6 LBS/LF  
CONCRETE = 0.30 CY/LF

QUANTITY (30" PILING CAP)  
3.5' X 2' CONCRETE CAP

STEEL = 34.6 LBS/LF  
CONCRETE = 0.26 CY/LF

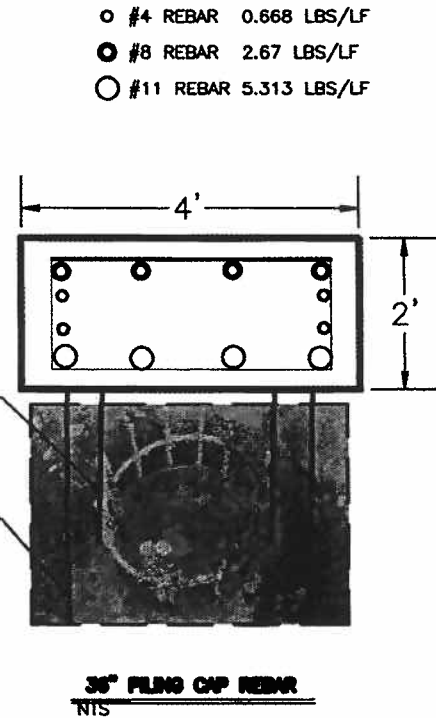
QUANTITY (24" PILING CAP)  
3' X 2' CONCRETE CAP

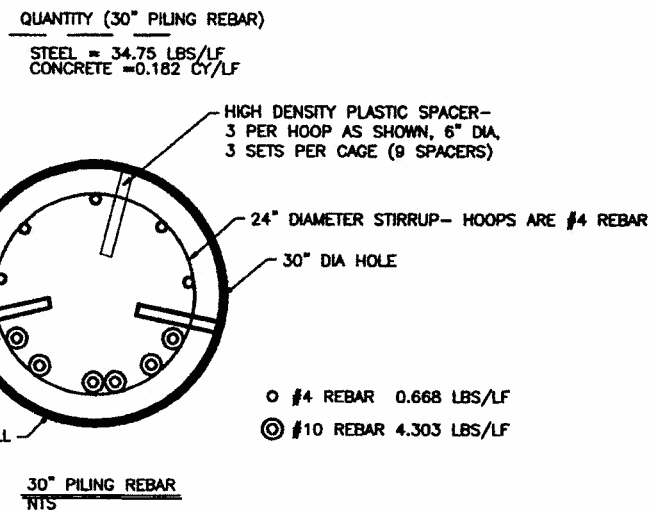
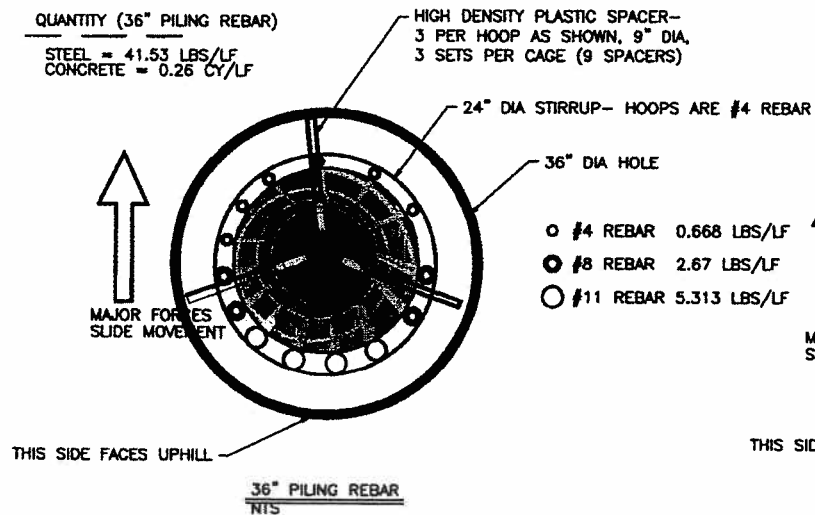
STEEL = 34.6 LBS/LF  
CONCRETE = 0.22 CY/LF



24" DIA CAGE EXTENDED THROUGH CAP WITH 2" CLEARANCE FROM TOP

36" DIA HOLE





NOTE:

1. SPACERS SHALL BE UTILIZED TO ENSURE REBAR CAGE STAYS CENTERED IN THE CASING.
2. SPACING OF CIRCULAR REBAR STIRRUPS SHALL BE 12" IN THE UPPER AND LOWER THIRDS OF THE PILE AND SHALL BE 6" IN THE MIDDLE THIRD.
3. VERTICAL REBAR GROUPS SHALL BE EQUALLY SPACED AS SHOWN WITH THE #11'S CENTERED ON THE BACK FACE.

